GAME DEVICE, PARTICULARLY FOR SEARCHING THE STATIC BALANCE OF A BODY

Field of the Invention

This invention relates to the field of games and entertainment and is directed to a game device, particularly aimed at reaching static equilibrium by one or more players, according to the preamble of claim 1.

More particularly, the invention relates to a game device comprising a support base, a substantially flat board, with a plurality of seats being appropriately arranged over the top surface of the board, connection means associated to the base for supporting the board while allowing it to freely swing or tilt about at least one transverse axis, a plurality of pieces which can be inserted in the seats in a predetermined arrangement to hold the board in a static equilibrium position.

Prior art

Gravity-based games have long been known, especially for young players, which utilize equilibrium or lack of equilibrium conditions, caused by the use of different weights, e.g. as disclosed in US-A-4043554.

From US-A-3188089 a game device is known which comprises a flat board resting on support means to rock about a substantially horizontal axis, and having two sets of housings which are arranged symmetrically on two portions of the board extending in opposite directions from the swinging axis. Pieces of equal weight are fitted in the housings in symmetric arrangement to hold the board in equilibrium conditions. The players may move the pieces step by step and alternately from their original equilibrium arrangement to a position shown at the end of the game board so as to displace the board from its equilibrium position, by following predetermined game rules.

Other games, based on the equilibrium of a board having housings for pieces or weights of equal or different weight are also disclosed in patents US-A-4200292, US-A-4389049 and US-A-4638999.

In all the above game devices, the board with the housings for the pieces may unrestrictedly swing about a center axis which passes through the center of gravity. Therefore, above a certain swinging angle, the pieces may come out from their seats and fall down, thereby completely losing their original arrangement and forcing the players to start anew their seek for the equilibrium condition. Furthermore, in these prior art devices, once a quasi-equilibrium position has been reached, the board cannot be temporarily disposed in a horizontal position to check if equilibrium may be approached by adding additional pieces.

Summary of the invention

An object of the present invention is to obviate the above drawbacks, by providing a game device which may be simply and readily used even by young or elderly people.

A particular object is of providing a game device which allows to memorize step by step the equilibrium or non-equilibrium condition that has been just reached without risk of losing it due to the board being turned over.

A further object is of providing a game device that allows to simply and effectively check if the arrangement of the pieces on the board provides an equilibrium condition.

These objects, as well as other objects that will be better apparent hereafter, are fulfilled by a game device for seeking the equilibrium of a body which, according to claim 1, comprises a stationary base, a support body, backing means for supporting said body on said base, allowing free swinging or tilting thereof, a plurality of seats associated to said body, a plurality of pieces of predetermined

weights, which may be removably inserted in the seats in such positions as to hold said body in a static equilibrium position, characterized in that it comprises control means which selectively interact with said body to hold it at least temporarily in said equilibrium position upon insertion of said pieces, both/either to limit its inclination relative to said base, thereby preventing said pieces from coming out and falling from said seats and/or to check if the equilibrium position has been reached.

Thanks to this arrangement, the players may seek the equilibrium of the support body in a relatively easy and stepwise manner, without losing the memory of the previous steps.

Preferably, the backing means include a point support member which defines a point for omnidirectional tilt or rotation of the body about a point that substantially coincides with its center of gravity.

Alternatively, the backing means may include a linear support member which defines a swinging axis for the body, substantially passing through its center of gravity.

In a preferred embodiment, the body is a substantially flat board having a top surface, a bottom surface and an axis substantially perpendicular to the surfaces and passing through its center of gravity.

Here, the plan shape of the board is selected from the group consisting of polygons, circles, ellipses, closed curves.

In another preferred embodiment, the body is a three-dimensional object with a substantially convex bottom portion defining a bottom portion supported by the base.

Suitably, the control means include positioning and abutment surfaces which may

be moved between body engagement and disengagement positions for interaction with the body.

It shall be noted that the arrangement of the pieces that is susceptible to hold the body in the equilibrium position may be determined by a mathematical algorithm based on the calculation of the weight moments relative to the center of gravity of the body. This algorithm may be of such a complex level, sometimes resembling a puzzle, as to attract and challenge the players and enhance their mnemonic and associative skills and forcing them to memorize the weight of the various pieces and the various colors associated thereto.

Brief Description of the Drawings

Further characteristics and advantages of the invention will be more apparent from the detailed description of a few preferred, non-exclusive embodiments of a game device according to the invention, which are described as non-limiting examples with the help of the annexed drawings, in which:

FIG. 1 is a top perspective general view of a first embodiment of the game device according to the invention;

FIG. 2 is a general bottom perspective view of the game device of FIG. 1;

FIG. 3 is a general exploded perspective view of the game device of FIG. 1;

FIG. 4 is a lateral view of the game device of FIG. 1;

FIG. 5 is a top view of the game device of FIG. 1;

FIG. 6 is a top perspective general view of a second embodiment of the game device according to the invention;

FIG. 7 is a general bottom perspective view of the game device of FIG. 6;

FIG. 8 is a general exploded perspective view of the game device of FIG. 6;

FIG. 9 is a lateral view of the game device of FIG. 6;

FIG. 10 is a lateral view of the game device of FIG. 6;

FIG. 11 is a top view of the game device of FIG. 6;

FIG. 12 is a top perspective general view of a third embodiment of the game device according to the invention;

FIG. 13 is a lateral view of the game device of FIG. 12;

FIG. 14 is a top view of the game device of FIG. 12;

FIG. 15 is a top perspective general view of a fourth embodiment of the game device according to the invention;

FIG. 16 is a lateral view of the game device of FIG. 15;

FIG. 17 is a top perspective general view of a fifth embodiment of the game device according to the invention;

FIG. 18 is a lateral view of the game device of FIG. 17;

FIG. 19 is a top view of a board of the game device according to the invention.

Detailed description of a few preferred embodiments

Referring to the above mentioned figures, a game device according to the invention, particularly for seeking the equilibrium of a body, is described, which is generally designated with numeral 1, and which may be used by one or more players.

In the drawings showing the various preferred embodiments, like elements will be designated, when needed, with like numerals.

The game device 1 basically comprises a body 2 which, in the most general form, is three-dimensional, e.g. representing a doll or a stylized head thereof, and has an outer surface 3, a plurality of appropriately shaped housings or seats 4 being associated thereto, and arranged in such a manner as to receive a plurality of game elements or pieces 5 allotted to the player/s. Suitably, the body 2 has an axis V passing through the center of gravity G which, in the equilibrium condition, generally designated as P, is substantially vertical.

As schematically shown in FIG. 20, backing means 6 are provided, which may form the lower portion of the body 2, and have a substantially cylindrical or spherical shape, which may lay over a substantially flat base 7, to allow the body 2

to swing along the point or line of contact with the base 7.

When a certain number of pieces 5 are inserted in the proper seats 4, the axis V passing through the center of gravity G will be substantially vertical.

In the embodiments as shown in FIGS. 1-19, the body 2 is essentially two-dimensional, i.e. a substantially flat board T having a thickness s, a top surface 3 and a plan shape selected amongst the figures belonging to the group of polygons, circles and ellipses. Preferably, the board T has a rectangular or square plan shape, which allows to arrange the seats 4 for the pieces 5 in a substantially even manner.

In all these embodiments, the board T is supported by suitable backing means, generally designated with numeral 6, to allow free swinging or tilting thereof on the base 7.

In short, by properly arranging a certain number of pieces 5 in the seats 4 in proper positions, the board 2 reaches a static equilibrium position, designated with P, which represents the "winning solution" of the game.

Preferably, the pieces 5 have substantially the same volume and appropriately different weights, according to a predetermined algorithm. Furthermore, the pieces 5 have at least a lower portion with a shape that is substantially identical and complementary to that of the seats 4, to allow insertion thereof regardless of their overall shape and weight.

Finally, the pieces 5 may have different colors depending on their weight, to facilitate memorization thereof by the players.

According to the invention, the device has control means, generally designated with numeral 8, which selectively interact with the body 2 to hold it at least temporarily in its equilibrium position P upon insertion of the pieces 5, both/either

to limit its inclination relative to the base 7, thereby preventing said pieces 5 from coming out and falling from the seats 4 and/or to check if the equilibrium position P has been reached.

Thanks to the provision of the control means, the board T may be held in equilibrium while the pieces 5 are inserted in the seats. Alternatively, the attainment of the equilibrium position P may be checked after inserting the pieces 5 in the seats 4 and operating the control means 8.

In the first embodiment, as shown in FIGS. 1-5, the backing means 6 are of the point support type and comprise a support member placed at the top of a load bearing column 9, which has a lower end anchored to the base 7 and to a free upper end.

Particularly, the point support member may be a ball 12, which is received in a seat of the free end 11 and may be engaged in a concave seat, designated with S, which is formed on the bottom surface 16 of the board T in the vicinity of its center of gravity G.

Suitably, the recess S has a greater radius of curvature than the ball 12, so as to minimize the contact surface approximately to a point. For the same purpose, a certain number of differently sized balls 12 may be provided, to obtain a contact surface as close to a point as possible.

Alternatively, the point support member may be formed by the tapering conical or frustoconical top 11 of the column 9.

The board T has eight seats 4 on its top surface 3, for receiving large or small ball pieces 5 of predetermined weights. By disposing the pieces 5 in the seats 4 in a predetermined arrangement, the board T will be held on the column 9 in a horizontal or other equilibrium position P.

In order to facilitate the equilibrium seeking game, an optical level bubble, not shown, may be mounted on the board T.

It shall be noted that the pieces 5 have different weights and their outer surfaces have different colors, to facilitate identification and memorization thereof by the player/s. However, sets of pieces 5 of equal weights may be provided to facilitate equilibrium seeking game, especially for young players.

To this end, the pieces 5 may be made from hollow balls filled with appropriate materials of equal or different specific weights.

Suitably, the control means 8 of the game device according to the embodiment of FIGS. 1-5 include positioning and abutment surfaces which may be moved between positions of engagement and disengagement of the board T for interaction therewith.

Particularly, the engagement means 8 comprise a plurality of substantially vertical rods 13, their respective lower ends 14 being anchored to the base 7 at peripheral positions relative to the central support column 9 and their upper ends 15 forming positioning and abutment surfaces for engaging and disengaging the bottom surface 16 of the board T.

In order to allow the positioning and abutment surfaces to move from the engagement position to the disengagement position, each bar 13 is height adjustable to move its free ends 15 up or down until they contact the bottom surface 16 of the board T. This may be achieved by providing each bar 13 with an upper portion 13' being movable or slideable relative to a stationary lower portion 13", e.g. by a nut and screw arrangement.

In operation, the player initially lays the board T "on the ground" and inserts the pieces 5 in the seats 4 in an intended equilibrium arrangement P, then he/she places the board T on the ball 12, with the bottom surface 16 in contact with the

ends 15 of the rods 13. Finally, the player lowers the ends 15 one at a time or simultaneously and checks if he/she has attained the equilibrium condition. If the player reaches equilibrium, he/she will win, otherwise, he/she shall keep on searching form the winning solution.

In an alternative embodiment, the backing means 6 include a linear support member which defines a swinging axis H for the board T, that passes through its center of gravity.

In one embodiment, not shown, the linear support member may be obtained by providing twice or three times as many columns 9 and corresponding support balls 12. Thus, the support points will be aligned along an axis that passes through the center of gravity G of the board T.

In the embodiment as shown in FIGS. 6-10, the control means 8 include at least three rods 17, with their upper ends 18 defining the positioning and abutment surfaces, adapted to engage the bottom surface 16 of the board 2. To this end, the rods 17 are fitted, in angularly staggered positions, on a sleeve 19 which is rotatably and slideably mounted on the load bearing column 9, which is integral with the base 7 along its substantially vertical axis V.

Suitably, the lower edge 20 of the sleeve 19 is inclined relative to a geometrical plane substantially perpendicular to the axis of the guide column 9, to cooperate with an inclined edge 21 of said column 9, thereby actually forming a cam mechanism.

Moreover, the sleeve 19 has a substantially radial operating rod 22 which may be driven by a player to rotate the sleeve about the axis V of the load bearing column 9, so as to cause the interaction between the cam means 20, 21 and the resulting axial displacement of the sleeve 19, and to move the free ends 18 of the rods 17 between positions of engagement and disengagement of the bottom surface 16 of the board T.

A single cylinder member, not shown, may be provided for supporting the board, instead of the rods 17.

In operation, unlike the previous embodiment, the player may reach for the equilibrium position "on the run" without having the prepare the board "on the ground". The player may lay the board T on the column 9 and insert one piece 5 at a time in the seats 4, with the ends 15 of the rods 17 in contact with the bottom surface 16 of the board 2, lower the sleeve 19, hence the ends 18 of the rods 17, and check if he/she has reached the equilibrium condition.

The embodiments as shown in FIGS. 12-16 have backing means 6 that differ from those of the previous embodiments in that they are formed by hanger means, whereas the control means 8 are unchanged, i.e. consisting of rods 17 integral with the sleeve sliding and rotating along the load bearing column 9.

In the device as shown in FIGS. 12-14, a point support member is provided which consists of a single substantially vertical flexible hanging member 23. Particularly, the flexible hanging member 23 has a bottom end 24 anchored to the board T at the center of gravity G thereof and the other end 25 anchored to a support frame 26 that is integral with the base 7.

Therefore, once the player has disposed the pieces 5 in the seats 4 in his/her selected arrangement, he/she may see if the board T maintains its equilibrium or abuts against one or more of the ends 18 of the rods 17.

The devices as shown in FIGS. 15 and 16 differ from those of FIGS. 12-14 in that the hanger means are formed by at least two, preferably three flexible members 23', 23", 23"', with their respective bottom ends 24', 24", 24"' being anchored to the board T along an axis H that contains the center of gravity G thereof, and the top ends 25', 25", 25"' being anchored to the frame 26 that is integral with the base 7.

In the embodiment as shown in FIGS. 17 and 18, the hanger means 6 are two

pivots 27, 28 anchored to the board T along the axis H that passes through the center of gravity G and pivotally supported in corresponding holes 29, 30 of the support frame 26.

Figure 19 is a top view of an exemplary embodiment of the board T, having sixteen seats 4 for receiving the pieces 5, and all the seats 4 being arranged symmetrically to the two orthogonal axes H, K passing through the center point of the board 2, that corresponds to the center of gravity G.

It shall be noted that the board 2, as well as the other parts of the device, are preferably made from a plastic material, such as PVC or polyurethane, although other natural or synthetic materials may be obviously also used, such as wood, Plexiglas, or metals such as aluminum or steel, provided they ensure the accuracy required for playing the game.

For the sake of completeness, it shall be noted that the game operation is based on the physical principle of vector equilibrium among the moments caused by the individual weights placed at a certain distance from an equilibrium point or axis V, and mainly depends on the number of game pieces and on their symmetrical or asymmetrical arrangement with respect to said point or axis.

If the arrangement of pieces 5 lacks any symmetry, the solution may be found by a vector equation in which the vector sum of the moments caused by the weights placed at a certain distance is equal to zero:

$$b1 \times P1 + b2 \times P2 + b3 \times P3 + \ldots . bn \times Pn = 0 ;$$

where b1, b2, b3, ... bn are the distances from the equilibrium point or axis of the game board and P1, P2, P3, ... Pn are the weights corresponding to the arms with the same index.

For a symmetric arrangement, e.g. of nine seats 4 for the pieces 5, composed of multiple lines or columns of equal numbers of seats and placed at the same

distance from each other, the first solution is given by nine pieces 5 over three lines or columns, in which the center piece fills the center position of the game board, at its center of gravity G.

In this case, this piece is ininfluent, as it causes no active moment, but contributes to the game, because it is included in the number of possible combinations.

The game with nine pieces 5 has a discrete number of solutions out of 362,880 possible combinations and a set of pieces 5 fulfilling the purpose of the game may be expressed, assuming 10 is the weight of the first piece 5, by the following sequence of numbers:

10, 15, 20, 25, 30, 35, 40, 45, 50.

If the center piece were removed, the configuration as described in the embodiments of the game of the previous Figures 1 to 18 would be obtained, having a discrete number of solutions out of 40,320 possible combinations. Here, the weight representing sequence of numbers is as follows:

10, 15, 20, 25, 35, 40, 45, 50.

When using a board with sixteen seats 4, instead of nine or eight, arranged over four lines and four columns, the game would have a discrete number of solutions, i.e. arrangement combinations, out of about $22 \cdot 10^9$ of possible combinations, and the sequence of numbers fulfilling the purpose of the game may be expressed, assuming 10 is the first weight, as follows:

10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85.

This kind of sequence is determined in such a manner that the difference between any two successive terms is constant, e.g. equal to 5 units, and it may be expressed ad follows: $Xn+1 = Xn + K = Xn + 5$ in this example.

Other kinds of sequences provide the same result, such as: $Xn+1 = Xn . K$ and also $Xn+1 =$ Summation of $X1 + X2 + \ldots Xn$.

In the latter preferred configuration, i.e. a sixteen-seat game board, other equilibrium solutions may be provided, by using a smaller number of pieces, starting with odd subsets of three and even subsets of four.

For instance, by only using 4 pieces, appropriately selected and indicated in the instructions from the original group of sixteen pieces, these four pieces 5 may be arranged in four of the sixteen available seats 4 to hold the board 2 in equilibrium.

This method allows to gradually reach higher difficulties up to the sixteen seat winning solution, having a very large number of combinations.

While the inventive object has been described with particular reference to the annexed drawings, they are susceptible to a number of changes or variants, within the inventive concept disclosed in the appended claims, which changes and variants are equally protected.

Also, all the details may be replaced by technically equivalent elements, and the materials may be different depending on different needs.